4.

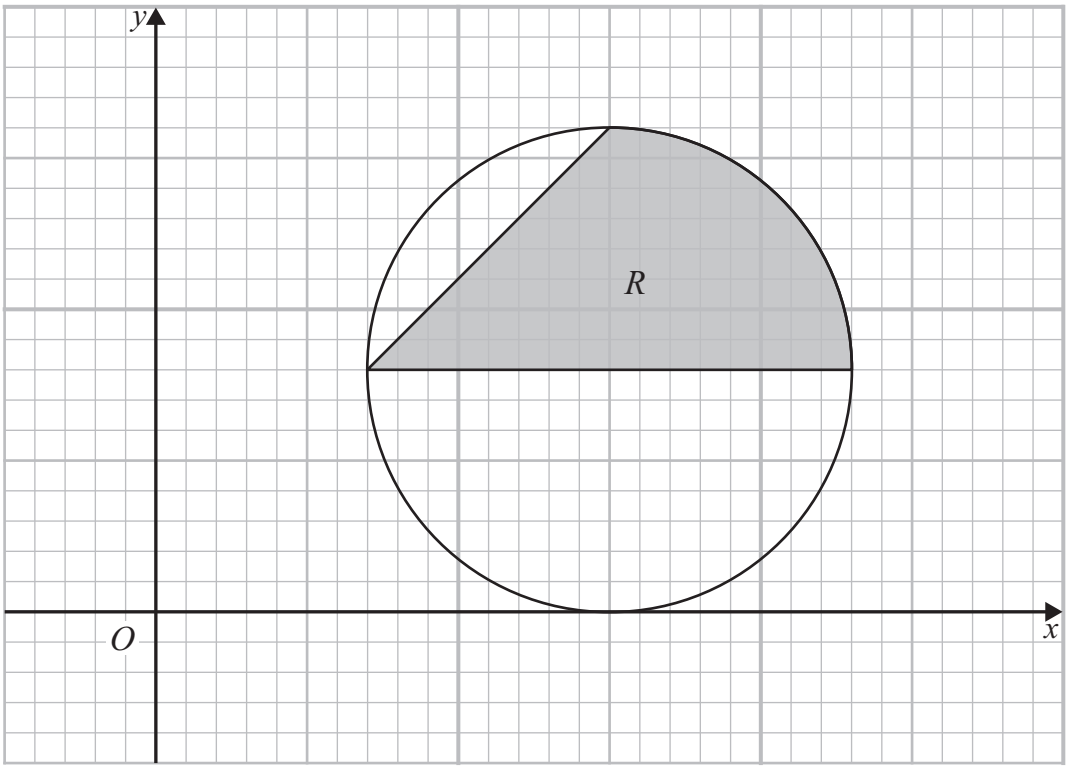


Figure 2

Figure 2 shows an Argand diagram for complex numbers of the form $z = x + \mathrm{i}y$.

The diagram is drawn accurately, although the scale is not shown on the axes.

Complex numbers that lie in the region R, shown shaded in Figure 2, satisfy all three of the inequalities

$$|z - 15 - 8\mathrm{i}| \leqslant a$$

$$0 \leqslant \arg(z + 1) \leqslant b\pi$$

$$|z + 2\mathrm{i}| \geqslant |z + c\mathrm{i}|$$

where a, b and c are real numbers.

(a) Determine the value of a, the value of b and the value of c

(3)

Given that the complex number w lies in the region R,

(b) determine the exact range of possible values of $|w|$

(3)

(c) determine the minimum value of arg w, giving the answer in radians to 3 significant figures.

(2)

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Question 4 continued

(Total for Question 4 is 8 marks)